FEDERAL AVIATION AGENCY

Washington 25, D. C.

TECHNICAL STANDARD ORDER

Regulations of the Administrator

Part 514

SUBJECT: AIRCRAFT TIRES ~~(HIGH SPEED)~~ TSO-C62

Technical Standard Orders for Aircraft Materials, Parts, Processes, and Appliances

Part 514 contains minimum performance standards and specifications of materials, parts, processes, and appliances used in aircraft and implements the provisions of sections 3.18, 4a.31, 4b.18, 6.18 and 7.18 of the Civil Air Regulations. The regulation uses the Technical Standard Order system which, in brief, provides for FAA-industry cooperation in the development of performance standards and specifications which are adopted by the Administrator as Technical Standard Orders, and a form of self-regulation by industry in demonstrating compliance with these orders.

Part 514 consists of two subparts. Subpart A contains the general requirements applicable to all Technical Standard Orders. These provisions are summarized below for the convenient reference of the public. Subpart B contains the technical standards and specifications to which a particular product must conform, and each Technical Standard Order is set forth in the appropriate section of Subpart B. The subject Technical Standard Order is printed below. ANY TECHNICAL STANDARD ORDER MAY BE OBTAINED BY SENDING A REQUEST TO FAA, WASHINGTON 25, D. C.

SUBPART A--GENERAL

This subpart provides, in part, that a manufacturer of an aircraft material, part, process, or appliance for which standards are established in Subpart B, prior to its distribution for use on a civil aircraft of the United States, shall furnish a written statement of conformance certifying that the material, part, process, or appliance meets the applicable performance standards established in this part. The statement of conformance must be signed by a person duly authorized by the manufacturer, and furnished to the Chief, Engineering and Manufacturing Division, Bureau of Flight Standards, Federal Aviation Agency, Washington 25, D. C.

Subpart A also requires appropriate marking of materials, parts, processes, and appliances as follows:

(a) Name and address of the manufacturer responsible for compliance,

(b) Equipment name, or type or model designation,

(c) Weight to the nearest pound and fraction thereof,

(d) Serial number and/or date of manufacturer, and

(e) Applicable Technical Standard Order (TSO) number.

In addition, Subpart A provides that no deviation will be granted from the performance standards established in Subpart B, and that the Administrator may take appropriate action in the event of noncompliance with Part 514.

SUBPART B

§ 514.67 Aircraft Tires - TSO-C62--(a) Applicability - (1) Minimum performance standards. Minimum performance standards are hereby established for aircraft tires, excluding tailwheel tires, which are to be used on civil aircraft of the United States. New type and new design tires, manufactured on or after April 15, 1961, which are to be used on civil aircraft of the United States shall meet the standards specified in Federal Aviation Agency Standard, "Aircraft Tires"[1/] dated February 15, 1961.

(b) Marking. In lieu of the marking requirements of Subpart A, aircraft tires shall be legibly and permanently marked with the following information:

(1) Brand name or name of the manufacturer responsible for compliance and the country of manufacture if outside the United States.

(2) The type, size, ply rating, and serial number.

(3) The qualification test speed and skid depth when the test speed is greater than 160 m.p.h., also, the word "reinforced" if applicable.

(4) Applicable Technical Standard Order (TSO) number.

(c) Data requirements. (1) One copy of the following data shall be furnished the Chief, Engineering and Manufacturing Division, Bureau of Flight Standards, Federal Aviation Agency, Washington 25, D. C., with the statement of conformance: tire type and size, static and dynamic load rating, ply rating, rated inflation pressure, outside diameter, skid depth, static unbalance, tire weight and a summary of the load speed-time parameters used in the high speed dynamometer tests.

(2) The manufacturer shall maintain a current file of complete design data.

(3) The manufacturer shall maintain a current file of complete data describing the inspection and test procedures applicable to his product. (See paragraph (d) of this section.)

1/Copies may be obtained upon request addressed to: Aeronautical Reference Branch, Correspondence Inquiry Section, MS-126, Federal Aviation Agency, Washington 25, D. C.

(d) Quality control. Tires shall be produced under a quality control system, established by the manufacturer, which will assure that each tire is in conformity with the requirements of this section and is in a condition for safe operation. This system shall be described in the data required under paragraph (c)(3) of this section. A representative of the Administrator shall be permitted to make such inspections and production tests at the manufacturer's facility as may be necessary to determine compliance with the requirements of this section.

(e) Previously approved equipment. Tire types of a specific design produced prior to April 15, 1961, may continue to be manufactured under the provisions of their original design and test standards.

(f) Effective date. April 15, 1961.

February 15, 1961

FEDERAL AVIATION AGENCY STANDARD
AIRCRAFT TIRES

1.0 Purpose. To specify minimum requirements for new aircraft tires, excluding tailwheel tires, for civil aircraft applications.

2.0 Scope. This specification covers minimum requirements for the following types of tires, having speed limitations as indicated.

(a) Type III, VII, and VIII (for ground speeds of 160 m.p.h. or less) hereinafter referred to as low speed tires.

(b) Type VII and VIII (for ground speeds greater than 160 m.p.h.) hereinafter referred to as high speed tires.

3.0 General Requirements.

3.1 Materials and Workmanship.

3.1.1 Materials. Materials shall be suitable for the purpose intended. The suitability of the materials shall be determined on the basis of satisfactory service experience or substantiating dynamometer tests.

4.0 Design and Construction.

4.1 Unbalance. The moment of static unbalance in ounce inches shall be no greater than the following moment values as applicable:

Type III tire diameters up to and including 28",
$\text{Moment} = 1.5D - .023D^2$

Type III tire diameters greater than 28",
$\text{Moment} = .031D^2 - .253D$

Type VII and VIII tire diameters up to and including 28",
$\text{Moment} = .01D^2 + .38D$

Type VII and VIII tire diameters greater than 28",
$\text{Moment} = .034D^2 - .304D$

D = Tire diameter (Actual)

4.2 Balance Marker. A balance marker, consisting of a red dot, shall be permanently branded into the side wall of the tire immediately above the bead to indicate the lightweight point of the tire.

4.3 Burst Pressure. New tires shall be capable of withstanding without failure a burst pressure of at least 4.0 times the rated inflation pressure.

4.4 Temperature. The airworthiness of tires shall not be adversely affected as a result of their being subjected to extreme ambient temperatures expected to be encountered during normal airplane operation.

4.5 Tread Design. Decreases in the number of tread ribs and grooves and increases in skid depth, made subsequent to tire qualification, shall be substantiated by the dynamometer tests contained herein for the applicable ground speed range involved.

4.5.1 Underskid Thickness. For tires and casings having ribbed type or nonskid tread patterns, the thickness of the rubber between the carcass and the bottom of the tread pattern shall not be less than 30 percent of the mold skid depth, except for helicopter tires, in which case, the minimum thickness shall not be less than 1/32 inch.

4.6 Slippage. Mounted tires, when tested in accordance with the dynamometer tests specified herein, shall show no evidence of slippage on the wheel rim during the first five dynamometer landings. Such slippage as shall subsequently occur shall not damage the tube or valve nor damage the air seal of the tire bead in the case of tubeless tires.

4.7 Tire Airworthiness. The tire shall withstand the dynamometer landings specified herein without failure or visible signs of deterioration other than normal expected tread wear.

5.0 Ratings.

5.1 Static Load Rating (Airplane Tires). Static load ratings shall be established on the basis of 35% deflection for Type III tires and 32% deflection for Types VII and VIII tires.

5.1.1 Static Load Rating (Helicopter Tires). Airplane tires qualified in accordance with the provisions of this standard may also be used on helicopters. In such case, the maximum static load rating may be increased by 1.5 without any additional qualification testing.

5.1.2 Deflection. The vertical distance from the top of the rim flange to the outermost surface of the tire at no load is considered as the distance equivalent to 100% deflection.

5.1.3 Deflection Tolerances. Deflection tolerances to allow for manufacturing variations shall not exceed +1%, -4% for Type III tires and +3%, -4% for Type VII and VIII tires.

5.2 Dynamic Load Rating, Nose Wheel Tires. The dynamic load rating (maximum permissible nose wheel tire load during braking) shall be determined as follows:

(a) Type III tires - 1.45 x static load rating.
(b) Type VII tires - 1.50 x static load rating.
(c) Type VIII tires - 1.40 x static load rating.

5.3 Inflation Pressure. The rated inflation pressure shall be established for each specific tire and shall be used as a basis when complying with the tire deflection provisions of Sections 5.1, 5.1.2, and 5.1.3.

5.4 Ply Rating. The ply rating shall be established on the basis of the static or dynamic load requirement, whichever is more critical.

6.0 Dynamometer Test Requirements.

6.1 Low Speed Tires. The tire shall withstand 200 landings on a dynamometer having a stored up kinetic energy computed as follows:

$KE = CWV^2$, where KE = Kinetic energy, ft. lbs.
W = Tire load, lbs.
V = 120 m.p.h.
C = 0.011

6.1.1 Tire Load. At landing, and during the entire roll test, the tire shall be forced against the flywheel at the rated static load of the tire.

6.1.2 Kinetic Energy. The kinetic energy of the flywheel shall be calculated for the rated maximum static load of the tire. In the event that

the correct number of flywheel plates cannot be used to obtain the calculated kinetic energy value or proper flywheel width, a greater number of plates shall be selected and the dynamometer speed shall be adjusted in order that the required kinetic energy may be obtained.

6.1.3 Dynamometer Speeds. The total number of dynamometer landings shall be divided into two equal parts having speed ranges as follows:

(a) In the first series of landings, the landing shall be at 90 m.p.h. and the unlanding at 0 m.p.h. The landing speed shall be decreased as necessary in order that 56 percent of the calculated kinetic energy is absorbed by the tire during this series.

(b) In the second series of landings, the landing shall be at 120 m.p.h. and the unlanding at 90 m.p.h. The unlanding speed shall be increased as necessary in order that 44 percent of the calculated kinetic energy is absorbed by the tire during this series.

6.1.4 Test Inflation Pressure. The test inflation pressure shall be that which is necessary to accomplish the same deflection on the flywheel under the rated static load as the flat plate deflection of the tire at its rated static load and inflation. This determination is made on the unused tire prior to the start of the test.

6.1.5 Landing Interval. The time between landings shall be chosen to be the minimum which will assure carcass peak temperatures of not less than 160°F. or contained air peak temperatures of not less than 140°F. for each run. Unavoidable deviations from the above shall be noted in the substantiating test data. Carcass temperatures shall be measured within one inch above the rim flange and in the shoulder or crown area.

6.2 High Speed Tires. Substantiation of the tire on the dynamometer shall realistically simulate, insofar as is practicable, runway operation and tire performance for the most critical combination of takeoff weight and speed and airplane center of gravity position. Consideration shall also be given to increased speeds resulting from elevated airport operations and high ambient temperatures. Representative load-speed-time data, compiled by the airplane manufacturer, shall be the basis for establishing the applicable dynamometer tests.

6.2.1 Dynamometer Test Speeds. Applicable dynamometer test speeds for corresponding maximum operational ground speeds shall be as follows:

Maximum Operational Ground Speed of Aircraft, m.p.h.		Dynamometer Test Speed m.p.h.
Over	Not Over	
160	180	180
180	200	200
200	225	225

6.2.2 Dynamometer Tests. The tire shall withstand 150 dynamometer landings. Fifty of these landings shall be in accordance with the load-speed-time test procedures specified below. Refer to Figs. 1 and 2 for graphic representations of this test. The above tests shall be followed by 100 landings at 90-0 m.p.h. as specified in Paragraphs 6.1 through 6.1.3(a). The provisions of Paragraphs 6.1.4 and 6.1.5 shall apply.

6.2.2.1 Speed Cycle. The tire shall be landed against a dynamometer flywheel rotating at a peripheral speed of S_1 m.p.h. Immediately thereafter, the flywheel's peripheral speed shall be decreased at an average deceleration rate of D ft./sec./sec. until a value of S_2 is attained. No specific rate of deceleration is required after the flywheel's peripheral speed reaches a value of S_2. The peripheral speed of the flywheel shall be decreased in the above manner until a roll distance of RD feet has been covered, at which time, the tire shall be unlanded.

6.2.2.2 Load Cycle. After landing, the load shall be increased from zero to L_1 pounds within T_1 seconds. The load shall then be further increased linearly with time to a value of L_2 pounds within T_2 seconds after landing, or at the moment of unlanding, whichever occurs first. If it is necessary to continue the roll after T_2 seconds (Ref. Fig. 1) in order to complete the required distance, the load shall be maintained at L_2 pounds until the required roll distance RD is completed.

6.2.2.3 Symbol Definitions. The numerical values which are used for the following symbols shall be determined from the applicable airplane load-speed-time data.

S_1 = Initial dynamometer test speed
S_2 = Speed at which the average deceleration D between S_1 and S_2 does not exceed the specified value.
D = Constant rate of deceleration between S_1 and S_2 speeds.
RD = Roll distance in feet
L_1 = Initial tire load
L_2 = Maximum rated static load of the tire.
T_1 = Time for applying L_1 load. A T_1 tolerance of $\pm$ one second is acceptable.
T_2 The elapsed time in applying the L_2 load

$$= \frac{S_1 - \sqrt{S_1^2 - 2D\,(RD)}}{D}$$

A T_2 tolerance of + 10% is acceptable. When T_2 is calculated by the aforementioned formula, S_2 may be ignored and D is assumed constant throughout roll distance RD. (Ref. Fig. 2)

6.2.2.4 Test Load Adjustment. If the test load curve, determined on the above basis,, results in loads at a given speed being less than those dictated by the applicable aircraft data then adjus tments should be made in T_2, L_1, and/or T_1 to eliminate this condition.

6.2.3 Taxi Test. The tire shall satisfactorily withstand at least three dynamometer tests under the following conditions.

Speed = 35 m.p.h.
Tire Load = Maximum static rating
Roll Distance = 35,000 feet

6.2.3.1 Tire Temperature. The tire shall be heated so that, at at the start of each of the three taxi test cycles, the tire test temperature shall be no less than 120°F. No adjustment shall be made in the inflation pressure to compensate for increases in air pressure due to temperature rise. Rolling the tire on the dynamometer is acceptable in obtaining the minimum 120°F. tire temperature.

6.2.4 Alternate Dynamometer Tests.

6.2.4.1 Variable Loading. Alternate dynamometer tests incorporating a variable loading procedure which more realistically simulates actual airplane performance on the runway may be used in lieu of the applicable load-speed-time schedules specified herein.

6.2.4.2 Alternate Procedure for Reinforced Tread Tires. Qualification of a given ply rating, reinforced tread, high speed tire in accordance with Paragraph 6.2.2 will automatically qualify a lesser ply rating reinforced tread tire of the same size and skid depth provided:

(a) The lesser ply rating tire, with a nonreinforced tread and identical carcass, has been qualified to the applicable requirements specified herein.

(b) The test conditions S_1, RD, D, S_2, T_1, and T_2 are not less severe than those applicable to the lesser ply rating tire.

(c) The ratio of the test loads L_1 to L_2 is not less than that applicable to the lesser ply rating tire. Any necessary adjustment in this ratio shall be accomplished by increasing L_1.

7.0 Optional Test Equipment. Dynamic tests may also be run on a test drum which is a fixed mass, provided the load, speed, time, and roll distance are identical to those which the tire would have if run on an inertia type dynamometer.

FIGURE 1

GRAPHIC REPRESENTATION OF LOAD-SPEED-TIME TEST WHEN TIME T_2 OCCURS BEFORE REQUIRED ROLL DISTANCE IS COMPLETED

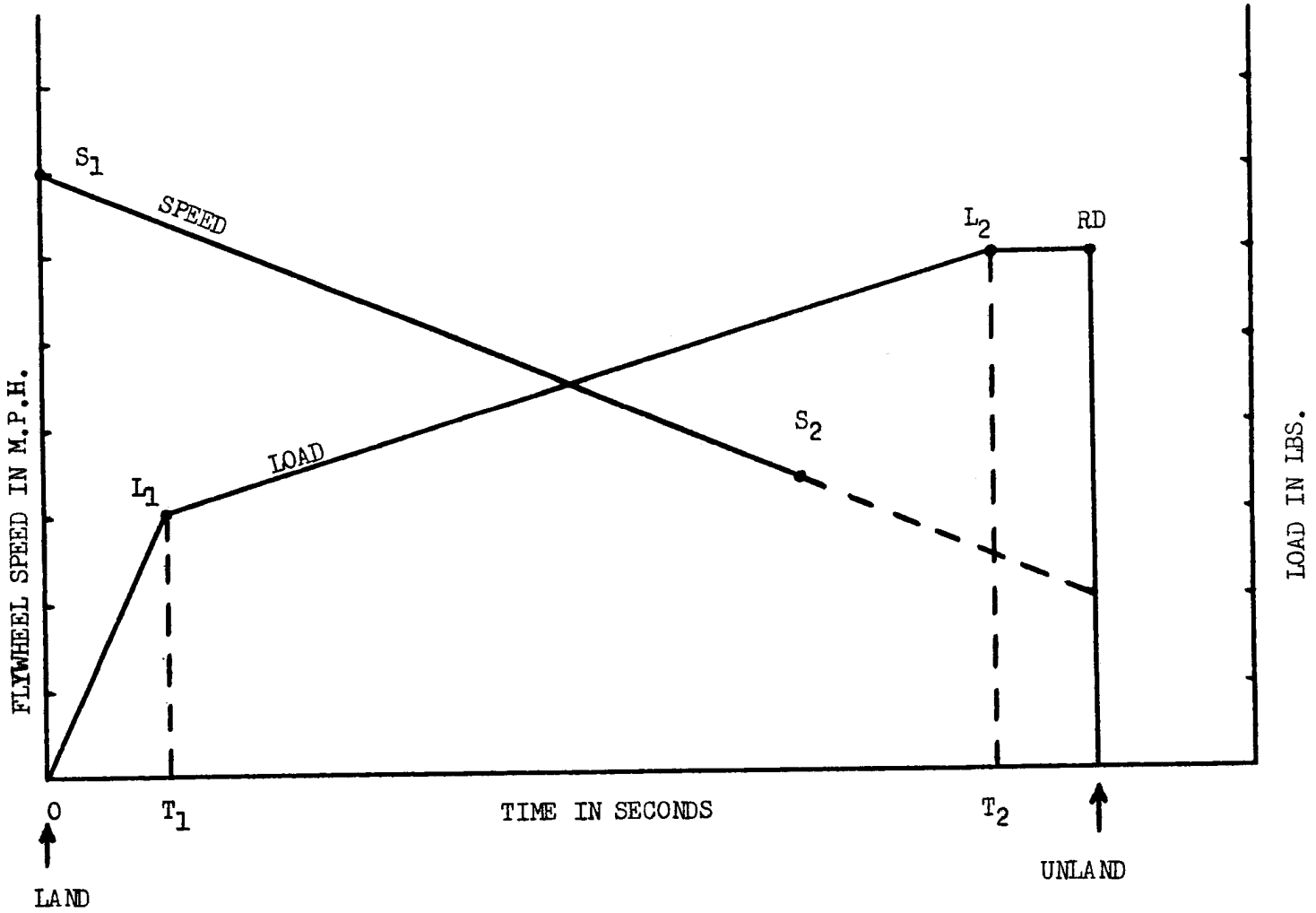
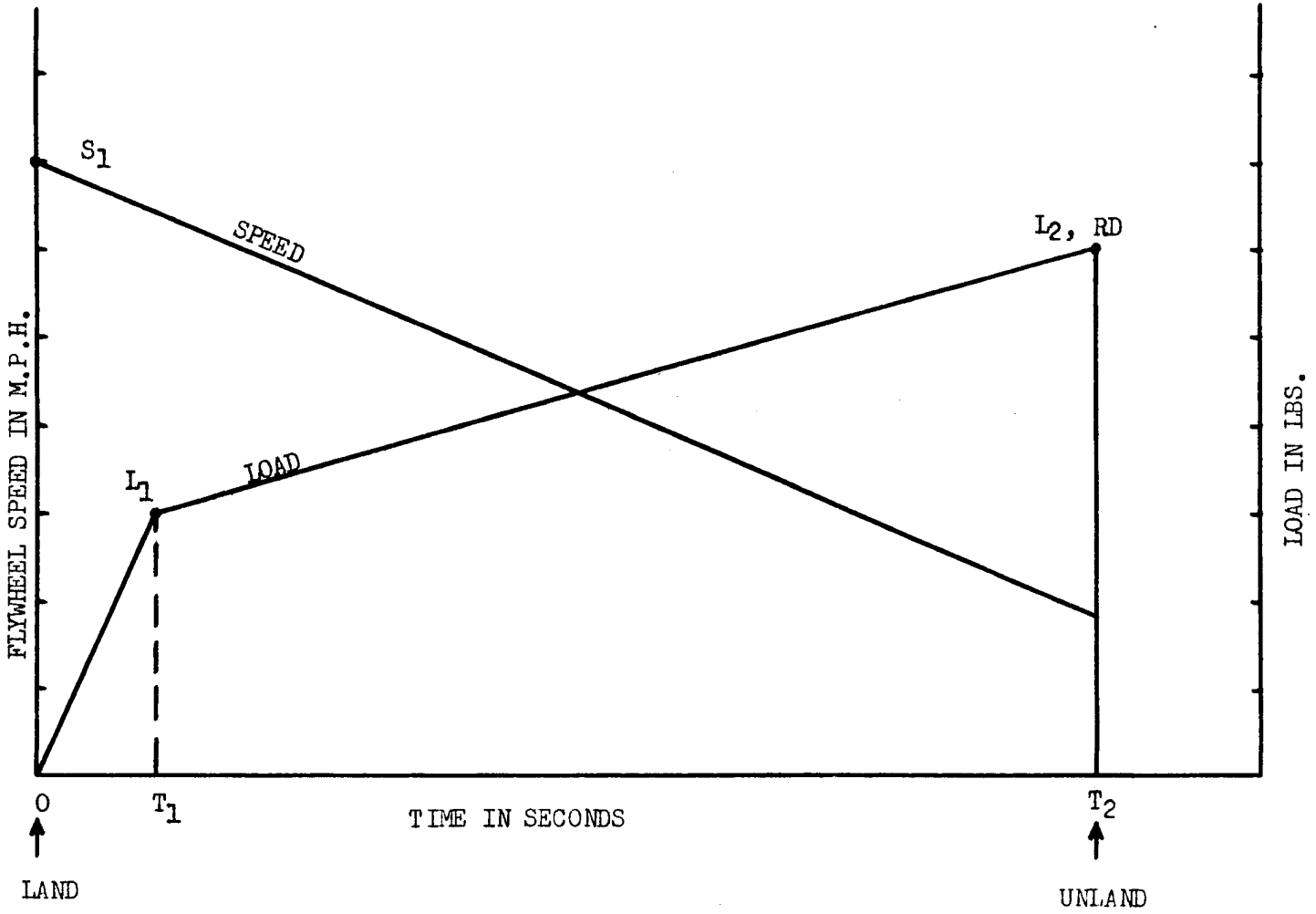


FIGURE 2

GRAPHIC REPRESENTATION OF LOAD-SPEED-TIME TEST WHEN T_2 IS CALCULATED



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